

Community Design and Physical Activity: What Do We Know? – and what DON'T we know?

Susan Handy
University of California Davis
May 2004

Introduction

Motivated by different concerns, urban planners and public health officials have joined together in the last several years to advocate for community design that promotes walking, biking, and other forms of physical activity. The Active Living by Design Program, for example, funded by the Robert Wood Johnson Foundation, aims to increase physical activity through community design by “providing leadership in promoting environments that offer choices for Active Living, a lifestyle that easily integrates physical activity into daily routines” (1). Although these efforts do not explicitly focus on families, their emphasis on neighborhood design raises an interesting and important question: how can community design effectively be used as a strategy for increasing physical activity for both children and their parents? In this presentation, I review what we know – and what we don't know – about the link between community design and physical activity for both adults and children and offer initial recommendations as well as questions for further research on what forms of community design most effectively increase physical activity for families.

Definitions and Model

To understand the link between community design and physical activity, it helps to separate physical activity into three categories. Each category of physical activity may be affected by community design in different ways. Active travel includes walking and biking for the purpose of reaching a particular destination. Walking, biking, running and other forms of exercise that involve movement over some distance fall into a second category, and more stationary forms of physical activity fall into a third category. These types of physical activity can also be differentiated by the settings in which they take place, for example, home, street, or neighborhood more generally. For families, physical activity can be further differentiated by whether the parent engages in physical activity without children, whether children engage in physical activity without parents, and whether they engage in physical activity together.

The concept of community design must also be defined. The term more commonly used by researchers is the “built environment.” I define this term as consisting of three elements: land use, transportation system, and design (2). Land use refers to the spatial distribution of activities throughout the community, in other words, what kinds of activities are located where. The transportation system provides the physical connections between activities and determines the quality of those connections in terms of travel times, safety, comfort, and other characteristics. Design refers to aesthetic qualities of the built environment and overlays both land use patterns and the transportation system, particularly in terms of the design of buildings and the design of streetscapes, respectively. More broadly, the “physical environment” refers not just to the built environment but also to the natural landscape and to human use of public spaces, elements that have the potential to influence choices about physical activity as well.

The link between community design and physical activity has often been studied using an ecological framework that differentiates between three or more levels of explanatory factors: intrapersonal (e.g. self-efficacy), interpersonal (e.g. social norms), and environmental (e.g. built environment) (3). For families, further articulation of the interpersonal level may be important, in particular with respect to relationships between parents and children. Studies have shown that parents influence physical activity levels in their children, by establishing rules, providing opportunities, or setting examples (e.g. 4, 5). On the other hand, the time demands of being a parent may restrict their ability to engage in physical activity. In addition, community design may interact with family relationships to influence levels of physical activity. Traffic levels in the neighborhood, for example, may lead a parent to put greater restrictions on a child's activity outside the home.

Adults and Physical Activity

The literature on the built environment and physical activity for adults comprises two bodies of work: studies from the travel behavior literature that examine the connection between the built environment and walking and biking as a mode of travel, and studies from the physical activity literature that examine the connection between the built environment and walking and biking and/or other forms of physical activity (2). In contrast to the physical activity studies, the travel behavior studies are motivated by a desire to shift travel from driving to walking or biking in the interest of reducing environmental impacts. The two bodies of work have used different theories and measurement techniques, though in both cases the studies are almost all cross-sectional.

Several general conclusions can nevertheless be drawn from these studies. Travel behavior studies show that walking (and biking, although it has been less frequently studied) is positively associated with higher population densities, shorter distances to destinations, higher levels of accessibility, and with traditional neighborhood design, though specific design variables have generally been insignificant. Physical activity studies show that total physical activity is positively associated with higher levels of accessibility, that use of a trail or bikeway is negatively associated with distance to the facility, and that walking is positively correlated with presence of sidewalks and perceived neighborhood aesthetics. These studies together point to the importance of accessibility (determined by land use patterns and the transportation system together); to a lesser extent, they also support the importance of design and aesthetics.

Although these cross-sectional studies produce evidence of correlations, they have often been interpreted as providing evidence of causality. The assumption in this case is that community design causes increases in physical activity, for example, that a walkable environment leads to more walking or that access to a gym leads to more exercise. Researchers increasingly acknowledge, however, that causal relationships may be considerably more complicated. Some evidence is available that shows that preferences may be more important than community design in explaining levels of physical activity and that preferences may in effect determine community design by influencing decisions about residential location. In other words, individuals who prefer to engage in physical activity may “self-select” into neighborhoods with better opportunities for physical activity. In addition, it is possible physical activity levels influence preferences for physical activity and even community design itself. Several new studies are underway that aim to sort out the direction and strength of the relationships between these variables.

The available research thus leaves us with many unanswered questions. Of much current interest to researchers is the question of self-selection: to what degree does self-selection explain the observed correlations between community design and physical activity? The limited evidence available so far suggests that self-selection may be an important factor (2). If so, then community design at least has a role to play in facilitating physical activity for those who want it. Researchers have not yet addressed whether community design might play a subtler causal role by encouraging physical activity in those who prefer not to exercise or even by changing their preferences for exercise over time. Such questions demand more sophisticated longitudinal studies than researchers have so far undertaken.

Children and Physical Activity

What we know about community design and physical activity for children is even more limited. A substantial body of research on physical activity in children has so far focused little attention on the influence of community design on physical activity for children. Travel behavior researchers, largely focused on problems of automobile dependence, have infrequently studied the travel behavior of children. The limited evidence available is often contradictory, and it is unclear if the findings that have emerged for adults will hold for children.

A number of studies have examined the link between neighborhood safety and physical activity for children but have produced counter-intuitive results. One study found that perceived neighborhood safety was not correlated with vigorous exercise outside of school for 9th and 11th graders (6). Another study found that perceptions of neighborhood hazards were positively associated with physical activity for 4th graders, suggesting that higher levels of physical activity may lead to greater awareness of neighborhood hazards (7). The evidence on proximity to playgrounds is also mixed. One study found that proximity to playgrounds was positively associated with physical activity in children (8), while another found that proximity to playgrounds was not associated with overweight for preschool children in low-income neighborhoods (9). Few conclusions can be drawn from the limited studies available and their inconsistent findings.

Findings from traffic safety studies provide clearer direction on community design. Studies have shown that traffic speed is a key determinant of pedestrian injury risk for children (10) and that speed humps, used to lower traffic speeds in residential areas, are associated with lower odds of children being injured within their neighborhoods and being struck by cars in front of their homes (11). These studies suggest that if streets are designed to limit traffic speeds, children will be safer. It then stands to reason that if children are safer, their parents are more likely to let them walk, bike, or play within the neighborhood. Recently completed studies of the California Safe Routes to School program provide further evidence of the link between traffic safety and physical activity. In Marin County, the number of children walking to school increased by 65% and the number of children biking increased by 114% following completion of traffic safety improvements around seven schools (12). In Southern California, the number of children walking or bicycling to school increased for five out of nine schools following completion of traffic safety improvements (13). In addition, evidence shows that boys who walk to school are more physically active over all than those who are driven (14).

A review by Sallis, et al. of the correlates of physical activity points reaches two conclusions related to community design: time spent outdoors is positively associated with physical activity for children, and opportunities to exercise are positively associated with physical activity for adolescents (15). These findings lead to the next question: how do we most effectively create opportunities for children and adolescents to get outside and play? Community design clearly plays a role, but whether backyards, front yards, streets, parks, community centers, or other facilities are most effective in encouraging outdoor play remains uncertain, as does the most effective community design for encouraging outdoor play for different ages and genders. New studies are needed to address these questions.

Compatibility?

We also don't currently know whether the most effective community design for promoting physical activity in parents is the same as or at least compatible with the most effective community design for promoting physical activity in their children. Let me share some new evidence that suggests that the needs of the two groups may be different. Patricia Mokhtarian and I are in the midst of a study of the relationships between residential location choice, neighborhood design, travel behavior, and physical activity. We selected eight neighborhoods in Northern California, four "traditional" neighborhoods and four "suburban" neighborhoods, and drew random samples of residents from each. We collected data on the variables of interest using a mail-out, mail-back survey and achieved a 25% response rate for a total sample of 1670 respondents. I present preliminary bivariate findings here for four measures of physical activity for respondents with children under the age of 16:

- The number of days in the last 7 days that the children living with the respondent played outdoors somewhere in the neighborhood (besides their backyard).
- The number of days in the last 7 days that the respondent exercised somewhere in the neighborhood hard enough to breathe somewhat harder than normal for at least 10 minutes.
- The number of times in the last 30 days that the respondent took a walk or a stroll around the neighborhood.
- The number of times in the last 30 days that the respondent walked from his or her residence to a local store or shopping area.

A comparison of the results for traditional neighborhoods and suburban neighborhoods shows statistically significant differences (Table 1). Physical activity for the respondent, whether in the form of exercise within the neighborhood, walking or strolling around the neighborhood, or walking to a local store or shopping area, is consistently higher in traditional neighborhoods. The differences for walking to the store are especially dramatic, reflecting differences in accessibility to stores in each of these neighborhoods. However, the frequency of children playing outdoors somewhere in the neighborhood is significantly higher for suburban neighborhoods than traditional neighborhoods. These data thus suggest a trade-off between physical activity for children and for their parents: suburban neighborhoods may be more conducive for physical activity for children than traditional neighborhoods, while the reverse may be true for their parents.

A comparison of the results for respondents who live on cul-de-sacs to those who don't is more mixed. As expected, a higher share of respondents in suburban neighborhoods lives on cul-de-sacs than in traditional neighborhoods: 24% versus 9%. The results for respondents living on cul-de-sacs may thus reflect other characteristics of suburban neighborhoods. Physical activity for the respondent in the form of exercise within the neighborhood or walking or strolling within the neighborhood is not significantly different for these two groups. The frequency of walking to the store appears higher for respondents who do not live on a cul-de-sac, though the difference is only marginally significant. The difference for the number of days that children played outdoors somewhere in the neighborhood is significantly different, however, with children living on cul-de-sacs playing outdoors over 50% more often than children not living on cul-de-sacs.

Although we have much additional analysis still to do, these results suggest the possibility that suburban neighborhoods are more effective in promoting physical activity in children than traditional neighborhoods and that cul-de-sacs are more effective than through streets. Although I suspect that most parents would say this finding is consistent with their experience, the trend within the planning field has been to promote more traditional forms of development, at least in part in the interest of promoting more walking and biking among adults and children alike. If our results hold after controlling for other variables (e.g. income, age of children, etc.), then new questions must be addressed: to what degree does the increase in physical activity for children in suburban neighborhoods make up for the decrease in physical activity for their parents, and, more importantly, what forms of community design can most effectively encourage physical activity for both parents and children?

Conclusions

Given the questions that remain about the link between community design and physical activity for both adults and children, we cannot safely say that certain changes in community design will lead to increases in physical activity. What we can safely say is that certain changes in community design will increase the opportunities for physical activity. The two clearest recommendations I can make based on the available evidence are to design streets for slow speeds and low levels of traffic and to put potential destinations, including parks and commercial areas, within walking distance. The first recommendation is most clearly needed for children, the latter most clearly for adults, but both groups should benefit from both recommendations. In carrying out these recommendations, however, planners need to be conscious of potential trade-offs between what is most effective for adults and what is most effective for children and find a solution that is optimal for both.

References

1. Active Living by Design. Active Living by Design, Available: <http://www.activelivingbydesign.org/> (Accessed 5/12/04).
2. Handy SL. Critical Assessment of the Literature on the Relationships Among Transportation, Land Use, and Physical Activity. Washington, DC: Transportation Research Board and Institutes of Medicine Committee on Physical Activity, Health, Transportation, and Land Use, 2004.

3. Sallis JF, Owen N. Ecological Models of Health Behavior. In: Glanz K, Barbara K. Rimer, and Frances Marcus Lewis, ed. *Health Behavior and Health Education: Theory, Research, and Practice*. Third ed. San Francisco, CA: Jossey-Bass, 2002.
4. Trost SG, Sallis JF, Pate RR, Freedson PS, Taylor WC, Dowda M. Evaluating a Model of Parental Influence on Youth Physical Activity. *American Journal of Preventive Medicine* 2003; **25**:277-282.
5. Sallis JF, Alcaraz JE, McKenzie TL, Hovell MF. Predictors of Change in Children's Physical Activity Over 20 Months: Variations by Gender and Level of Adiposity. *American Journal of Preventive Medicine* 1999; **16**:222-229.
6. Zakarian JM, Hovell MF, Hofstetter CR, Sallis JF, Keating KJ. Correlates of Vigorous Exercise in a Predominantly Low SES and Minority High School Population. *Preventive Medicine* 1994; **23**:314-321.
7. Romero AJ, Robinson TN, Kraemer HC, Erickson SJ, Haydel KF, Mendoza F, Killen JD. Are Perceived Neighborhood Hazards a Barrier to Physical Activity in Children? *Arch Pediatr Adolesc Med* 2001; **155**:1143-1148.
8. Sallis JF, Nader PR, Bryoles SL, Berry CC, Elder JP, McKenzie TL, Nelson JA. Correlates of Physical Activity at Home in Mexican-American and Anglo-American Preschool Children. *Health Psychology* 1993; **12**:390-398.
9. Burdette HL, Whitaker RC. Neighborhood playgrounds, fast food restaurants, and crime: relationships to overweight in low-income preschool children. *Preventive Medicine* 2004; **38**:57-63.
10. Jacobsen P, Anderson CL, Winn DG, Moffat J, Agran PF, Sarkar S. Child Pedestrian Injuries on Residential Streets: Implications for Traffic Engineering. *ITE Journal* 2000:71-75.
11. Tester JM, Rutherford GW, Wald Z, Rutherford MW. A Matched Case-Control Study Evaluating the Effectiveness of Speed Humps in Reducing Child Pedestrian Injuries. *American Journal of Public Health* 2004; **94**:646-650.
12. Staunton CE, Hubsmith D, Kallins W. Promoting Safe Walking and Biking to School: The Marin County Success Story. *American Journal of Public Health* 2003; **93**:1431-1434.
13. Boarnet M, Day K, Anderson C, McMillan T. Safe Routes to School: Report to the Legislature. Sacramento, CA: California Department of Transportation, 2003.
14. Cooper AR, Page AS, Foster LJ, Qahwaji D. Commuting to School: Are Children Who Walk More Physically Active? *American Journal of Preventive Medicine* 2003; **25**:273-276.
15. Sallis JF, Prochaska JJ, Taylor WC. A Review of Correlates of Physical Activity of Children and Adolescents. *Medicine and Science in Sports and Exercise* 2000; **32**:963-975.

**Table 1. Physical Activity in Traditional vs. Suburban Neighborhoods
Respondents with Children Under Age 16**

	Traditional Neighborhoods	Suburban Neighborhoods	Probability
Times in last 7 days that children played outdoors somewhere in neighborhood	1.54	2.24	0.00
Time in last 7 days that respondent exercised somewhere in neighborhood	2.13	1.55	0.03
Times in last 30 days that respondent walked in the neighborhood	9.71	7.75	0.03
Times in last 30 days that respondent walked to a store	4.67	1.60	0.00

**Table 2. Physical Activity for Living on Cul-de-Sac vs. Not Living on Cul-de-Sac
Respondents with Children Under Age 16**

	Living on Cul-de-Sac	Not Living on Cul-de-Sac	Probability
Times in last 7 days that children played outdoors somewhere in neighborhood	2.68	1.75	0.00
Time in last 7 days that respondent exercised somewhere in neighborhood	1.75	1.83	0.82
Times in last 30 days that respondent walked in the neighborhood	8.08	8.77	0.55
Times in last 30 days that respondent walked to a store	2.27	3.16	0.09